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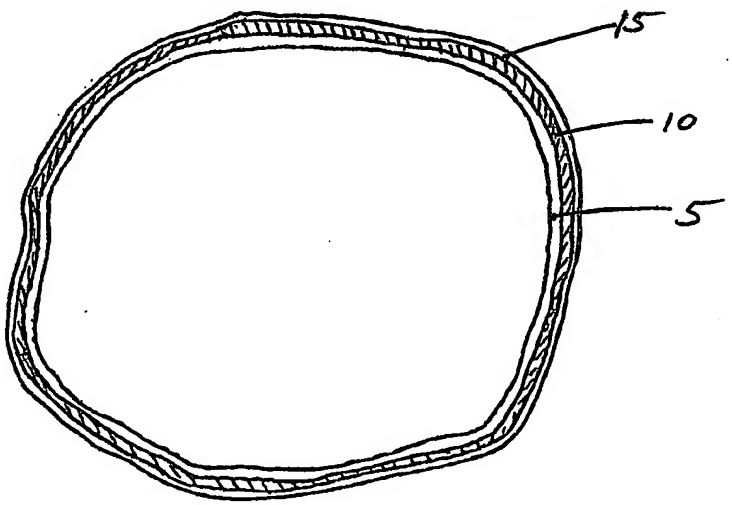
(54) Title: FLAVOUR TRANSFERABLE FOOD CASING



(57) Abstract: There is described the use of a loadable polymer in the preparation of a polymeric film suitable for wrapping food products, wherein said loadable polymer comprises a food flavourant, colourant and/or perfume. Also described is a food casing comprising a polymeric film produced using a loadable polymer and a method of preparing the food casing.

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FLAVOUR TRANSFERABLE FOOD CASING

The present invention relates to flavour-transferable polymeric casings for food. In particular the present invention relates to smoke flavour-transferable multilayer plastic tubular food casing.

Polymeric or plastic casings are well known in the processed food industry. Such casings are typically ubular in form and are used to contain and package foods such as cheeses and sausage meat. Such foods may be generally cured, additionally flavoured or smoked prior to their being packaged within the plastic casing. Processing after packaging is generally not done because the plastic casing presents a barrier, thus preventing the substances used in flavouring, curing or smoking from reaching the food within. Polyamide casing materials provide good meat adhesion, have high impact strength, high resistance to cooking conditions such as high temperature, and provide a good oxygen barrier to the food contained within. Polyamide materials may be used in combination with polyethylene casing materials to provide multi-layered casings. Polyethylene casing materials tend to be corona treated to give good adhesion with meats and additionally, polyethylene casings provide a good moisture barrier which reduces deterioration to give a long shelf-life to the packaged foods. The outermost layer of a multi-layered casing may include a UV barrier additive to further prevent deterioration of the packaged food.

A variety of flavouring or curing agents may be used in processing packaged foods. A curing and smoking agent which imparts a particularly pleasing smoked flavour, aroma and colour to foods is used with cellulose food casings and is known as "liquid smoke". This substance is a well known material or class of materials, which may also be referred to as "liquid smoke solution", "wood-smoke condensate", "aqueous wood smoke condensate", "smoke liquid", "wood-smoke distillate", "condensed smoke", "condensed smoke solution", "natural wood smoke flavour", "distillate obtained from cellulose-containing substances", and "liquid aqueous solution of smoke flavours". Various liquid smokes are known, all of which are believed usable in the present invention.

Liquid smoke is often a solution of natural wood smoke flavours prepared by burning a wood, for example, a hickory or a maple, and capturing the natural smoke flavours in a liquid medium, for example, water. Alternatively, the liquid smoke to be used may be derived from the destructive distillation of a wood, that is, the breakdown or cracking of the wood fibers into various compounds which are distilled out of the wood residue. Most liquid smokes are very acidic, although some partially neutralized liquid smokes and even highly alkaline liquid smokes having a pH of approximately 12-13 are also available. The liquid smoke can be used at full strength as marketed or can be diluted by water or other appropriate diluent.

The liquid smoke that is generally preferred is a

solution of natural wood smoke flavours. This liquid smoke is produced by the limited burning of hardwoods and the absorption of the smoke so generated into an aqueous solution under controlled conditions. The limited burning keeps some of the undesirable hydrocarbon compounds or tars in an insoluble form, thereby allowing removal of these constituents from the final liquid smoke. Thus, by this procedure, the desirable wood flavour constituents are absorbed into the solution in a balanced proportion and the undesirable constituents may be removed. The resulting liquid smoke solution is representative of the whole preferred spectrum of smoke flavours without a preference of any one type. The apparatus and method for manufacturing a typical liquid smoke is more fully described in the US Patent No 3,106,473.

Liquid smoke permits "in situ" smoking which is a particularly attractive method for imparting a smoked colour, aroma and/or flavour to a food product. Such a method involves packaging an unsmoked food within a cellulose casing incorporating liquid smoke and which is capable of imparting a smoked colour, aroma and/or flavour to the food contained therein. This method eliminates an initial food smoking step thereby simplifying the production of such foods.

Plastic casings, rather than cellulose or fibrous casings, are preferred because they tend to be less expensive to manufacture, have longer shelf life and less packaging is required. Incorporation of liquid smoke into

a plastic casing however is problematic. The term "plastic" referred to herein refers to a synthetic polymer which is not cellulose or collagen. Such a plastic is typically a thermoplastic such as polyethylene, polypropylene or polyamide. Mixtures of these polymers and copolymers thereof may also be used. Plastic casings are typically manufactured by an extrusion process. Such a process typically involves adding pellets of plastic to an extruder at elevated temperature where the plastic pellets melt prior to expulsion through the orifice of a die. In this way thin flat films or tubes can be made. Liquid smoke however, contains a certain proportion of water which prevents it being co-extruded with the typical plastic materials used for food casings at typical extrusion temperatures due to the generation of steam and possibly other gases. Furthermore liquid smoke generally does not mix well with the plastic materials used for food casings, which, without wishing to be bound by theory, is apparently due to the differing polar properties of the liquid smoke and plastic materials. For example, typically the liquid smoke is an aqueous solution and the plastic materials are hydrophobic. Incorporation of liquid smoke into such polymers is thus very difficult.

It is an object of the present invention to obviate or mitigate the above mentioned disadvantages. In particular it is an object of the present invention to provide a flavour, colour and/or aroma releasing plastic food casing.

According to a first aspect of the present invention

there is provided, use of a loadable polymer in the preparation of a polymeric film suitable for wrapping food products, wherein said loadable polymer comprises a food flavourant, colourant and/or perfume.

Loadable polymers allow certain materials, particularly liquid materials and solutions, to be incorporated therein. This incorporation involves a physical process and does not require the liquid material to be chemically bound, for example through covalent bonds, to the polymer. Such physical loading is achievable because loadable polymers are microporous, that is, contain large numbers of small holes to give a porous network throughout the bulk of the polymer.

Flavourants, colourants and/or perfumes may can be incorporated into loadable polymers, and by means of suitable processing we have found that, liquid smoke can be loaded into such loadable polymers, which are typically in granule, pellet or powder form, to give a free flowing solid particulate product. The present invention is particularly suited to flavourants, colourants and/or perfumes in liquid form or as solutions. A preferred liquid smoke for incorporation into a loadable polymer according to the present invention is an alkaline aqueous solution liquid smoke.

Suitable flavourants/perfumes other than liquid smoke may be chosen from the group consisting of aroma extracts of garlic, caraway seed, pepper, red pepper and a grill flavour and mixtures thereof. Suitable colourants other

than that provided by liquid smoke may be chosen from annatto extract, erythrosine, amaranth, brown FK, tartrazine, black BN and caramel and mixtures thereof. These flavourants/colourants/perfumes may also be mixed with liquid smoke.

Apart from liquid smoke, a grill flavour is preferred and may be obtained under the trade name Grillin from the company Red Arrow.

Apart from liquid smoke, a preferred colourant is carmel which may be obtained from Werner-Jenkinson.

Loaded polymers, once loaded with a particular liquid material(s) such as liquid smoke may be extruded in suitable quantities with a base polymer under melt extrusion conditions to form an extruded polymeric film suitable for wrapping food products and having an even distribution of the liquid material.

Suitable loadable polymers include polypropylene, polyethylenes such as low density polyethylene, high density polyethylene and linear low density polyethylene; and polyamides such as polyamide 6.

Suitable base polymers to which the present invention may be applied are any of those commonly used to manufacture food casing such as polyamides, for example, polyamide 6 (polycaprolactam or alternatively poly-ε-caproic acid amide), polyamide 7 (polyamine - oenanthic acid amide) polyamide 6,6 (polyhexamethyleneadipic acid amide), and polyamide 6,10 (polyhexamethylenesebacic acid amide) and mixtures thereof may be used. Polyamide

copolymers may also be used. Other base polymers to which the present invention may be applied are polypropylene, polyethylene, (such as high density polyethylene, low density polyethylene and linear low density polyethylene), and mixtures and copolymers thereof.

Typically the loadable and the base polymer belong to the same polymer family. Advantageously the loadable polymer and the casing base polymer may be made from the same material thus obviating the need to introduce any other polymer material which may compromise casing production or properties. A preferred polymer for use both as the loadable polymer and as the base polymer is nylon-6 (which is a polyamide).

It has been found that liquid smoke initially containing 40-90% water, preferably 40-60% water, more preferably 50% water can be loaded into a loadable polymer comprising nylon-6 with the total water content of the liquid smoke loaded polymer being as low as about 3% or lower which enables hot melt extrusion when the loaded polymer is added to the base polymer in a suitable amount. The loaded, loadable polymer may hold up to about 75% liquid smoke, preferably about 65% liquid smoke. Typically about 3% by weight of liquid smoke loaded, loadable polymer is used compared to the total weight of base polymer and loaded, loadable polymer mixture and this achieves an acceptable level of releasable smoke flavours from the food casing.

Accordingly the present invention also provides a

method of preparing food casing comprising the steps of:

providing a loadable polymer;

loading said loadable polymer with liquid material to give a loaded, loadable polymer; and

mixing and extruding said loaded, loadable polymer with a base polymer to give a food casing.

The liquid material may be any desired liquid material or solution which provides a flavour, colour and/or perfume to a food product as described herein. Preferably, the liquid material is an aqueous liquid smoke solution.

It has been found that diluting a 50% by weight aqueous solution of liquid smoke to 25% with water aids loading in microporous nylon-6 pellets. Typically the diluted smoke solution is mixed with the loadable nylon-6 polymer pellets and the resultant mixture heated to about 50°C-90°C, typically below 80°C and preferably about 60°C and subjected to a pressure below atmospheric pressure such as 0.8 bar. Under these conditions the water evaporates, leaving the liquid smoke substantially within the nylon-6 pellets. Evaporation is continued until a water content of about 3% by weight is reached. The resultant loaded polymer pellets may then be mixed and extruded with base polymer as previously described using conventional extrusion techniques. Such loaded polymer pellets may be termed masterbatch polymer.

Extrusion methods known in the art may be used to give the food casing. A preferred method is the biaxially stretched oriented method, for example, using blown film

techniques. Any method suitable for giving multi-layered casing may be used and, therefore, further processes or steps occurring before, during or after the extrusion step may be used as desired to give a multi-layered casing.

The present invention also provides a casing comprising a polymeric film wherein said film comprises liquid smoke and is produced using a liquid smoke loaded, loadable polymer.

Typically a seamless continuous tubular film is extruded although other configurations may be envisaged such as flat film. In particular, multi-layered tubular configurations are required which comprise a film incorporating liquid smoke according to the present invention.

It is desired that an innermost layer comprises a film incorporating liquid smoke according to the present invention which releases smoke flavour, aroma and/or imparts a colour to the food contained within the film. It is also desirable for an outer layer, preferably the outer most layer, to be impermeable to, i.e. provide a barrier, to prevent the smoke flavour, aroma and/or colour from escaping or leaching from the interior of the wrapped food product to the exterior. The barrier layer will typically comprise polyamide or polyethylene.

Such multi-layered films may be produced using co-extrusion techniques and may be biaxially stretched and may contain any suitable number of layers. For example, the film of the present invention may be incorporated within

any type of multi-layered film, such as the tubular multi-layered films described in US Patent No 4,303,711. The layers may number 1 to 10, but typically 1 to 7. Desirably 1 to 5 or 1 to 3 layers is preferred. A 2 layer film typically comprises an inner layer incorporating liquid smoke according to the present invention and an outer layer comprising a blend of polyamide 6, ionomer resin and polyamide copolymers. A preferred outer layer composition is obtainable under the trade name of Rale. Most preferably use is made of a three layer film and wherein the innermost layer (which contacts the food when contained within the casing) comprises a film according to the present invention incorporating a liquid smoke, the outermost layer is a polyamide such as nylon-6 and a core layer disposed between the innermost and outermost layers is a polymeric tie layer. Alternatively 5 layers is used wherein the innermost layer comprises a film according to the present invention incorporating a liquid smoke, the layer contacting the innermost layer comprises a polymeric tie layer, the next outer layer comprises a polyolefin, the next outer layer comprises a polymeric tie layer and the outermost layer comprises polyamide. Preferably the innermost layer is a polyamide incorporating liquid smoke and the polyolefin layer is a polyethylene, thus giving the structure: polyamide incorporating liquid smoke layer/polymeric tie layer/polyethylene layer/polymeric tie layer/polyamide layer.

Alternatively, a 7 layer film may be used having the

same structure as the 5 layer film described above except that an ethyl vinyl alcohol polymer layer is present on the innermost side of the outermost polymeric tie layer and an additional polymeric tie layer is disposed between the polyolefin layer and the vinyl alcohol polymer layer thus giving the structure: polyamide incorporating liquid smoke/polymeric tie layer/ polyolefin layer/polymeric tie layer/ethyl vinyl alcohol polymer layer/polymeric tie layer/polyamide layer.

The polymeric tie layer acts like a glue and enables the two layers between which it is disposed to be bonded together. The polymeric tie layer usually comprises a polyolefin such as polyethylene mixed with a cross-linked ionomer for example, 50% by weight polyethylene mixed with 50% by weight ionomer. Suitable ionomer resins for use in this invention are described in US patent No. 4 303 711. For example, such ionomer resins may be copolymers of ethylene with an α,β-ethylenically unsaturated monocarboxylic acid. Preferably the ethylene content is at least 50 mole % and the remainder of the resin being formed from an acid derivative and/or an acid monomer of said acid, preferably in quantities of 5 to 25 mole % with respect to the copolymer. Preferred acid derivatives are alkyl esters or acid anhydrides of said acids. Ionomer resins of this type have a melt flow index of from approximately 0.5 to 40, preferably 0.5 to 10, and contain a uniform distribution of metal ion having a valency of 1 to 3, preferably 2. Preferably at least 10% of the

carboxyl groups of the acid in the copolymer are neutralised by the metal ion which is present in the ionic state.

Preferred ionomer resins are those containing inorganic metal salts of ethylene/acrylic acid or ethylene/methacrylic copolymers that contain the acrylic acid or methacrylic acid monomers respectively, copolymerised in a quantity of approximately 2 to 25% by weight. Preferred inorganic metal salts are zinc and calcium salts. This type of ionomer resin can be obtained from DuPort Chemical Co. under the trade name Surlyn Resin.

The film layer according to the present invention incorporating liquid smoke which is an inner layer of a multi-layer casing typically has a thickness corresponding to the desired amount of flavour and/or colour and/or aroma to be transferred to the food contained within the multilayer film casing. Thus, a thicker inner film layer may be used for transferring a greater amount of flavour and/or colour and/or aroma to the food. The inner film layer typically has a thickness in the range about 10μm-60μm, preferably about 10μm-40μm, most preferably about 20μm.

Outer film layer thickness are generally chosen to provide a desired degree of strength to the multi-layer food casing. Typical outer film layer thickness are in the range about 10μm-60μm, preferably about 10μm-40μm, most preferably about 15μm-20μm.

Typical thickness of a tie layer is in the range about

10μm-60μm, preferably about 10μm-40μm, most preferably about 20μm.

Other film layers which are not tie layers and are disposed between the inner and outer film layers as described herein typically have thicknesses comparable with the outer film layer, for example in the range about 10μm-60μm, preferably about 10μm-40μm, most preferably about 15μm-20μm.

Total thickness of a multi-layered film which forms a food casing is typically in the range of about 20μm-200μm, preferably about 30μm-100μm, most preferably about 40μm-60μm which is less than about 75μm.

The multi-layered films which form casings according to the present invention may be made in various widths, which is measured for convenience as flat width. This flat width is typically in the range of about 20mm-500mm, preferably 40mm-450mm. Representative widths may be selected from about 450mm, about 300mm, about 200mm, and about 50mm.

The present invention will now be described by way of non-limiting example in which:

Example 1 is a method of incorporating liquid smoke into loadable nylon-6 pellets and their subsequent use as a masterbatch additive in extruding nylon-6 film.

Example 2 refers to use of the polymer blend of Example 1 in producing a three layer tubular casing.

Example 3 presents a taste evaluation of a product packaged within the film produced in Example 1.

Example 4 describes an analytical experiment to show smoke transfer to water contained within the 3 layer tubular casing produced in Example 2.

EXAMPLE 1

A 50% by weight smoke liquid solution was diluted with water to give an approximately 25% solution. This dilution lowered the viscosity of the solution which allowed better incorporation of the smoke into the nylon-6 pellets.

The diluted smoke solution was then mixed with enough microporous nylon-6 pellets (available commercially under the trade name Accurel) sufficient to achieve a smoke loading of 65% by weight. This figure includes a final water content of 3% by weight.

The mixture was then stirred and heated to 60°C. A reduced pressure of 0.8 bar was then applied while the mixture was tumbled in a rotary dryer until the water had evaporated and a final water content of 3% by weight was reached.

The loaded pellets prepared according to the above method were then blended with polyamide in a proportion of 3% by weight loaded pellets to 97% by weight polyamide. The resultant blend was then extruded using conventional blown film methods.

It should be noted that solvents other than water were tried in the first dilution step of the above process. However, although these were able to dilute the liquid smoke, it was found that in the subsequent distillation of the solvent, a significant amount of smoke was also

extracted from the mixture.

EXAMPLE 2

The resultant polymer blend of Example 1 was extruded and incorporated into a three layer tubular casing which is schematically shown in cross section in Figure 1. The inner layer 5 is made from the resultant polymer blend produced in Example 1 which incorporates liquid smoke and is 20μm thick. The middle layer 10 is a tie layer made from 50% by weight crosslinked ionomer obtainable from Du Pont under the trade name Surlyn mixed with 50% by weight polyethylene. The outer layer 15 is a barrier layer to prevent escape of the liquid smoke constituents and is made of polyamide-6.

EXAMPLE 3

Two samples of plastic film were prepared according to the method of Examples 1 and 2. Both samples were tubular film with one sample having a flat width of 53mm (Sample No. 1) and the other sample having a flat width of about 300mm (Sample no.2). These samples were compared to a commercially available casing obtainable under the trade name Ralen (Sample No. 3). This casing was absent of any smoke treatment.

All three casings were filled with a meat emulsion and cooked as follows:

- Heating until the internal temperature was 70°C,
- Holding at this temperature for 10 minutes, and
- Subjecting to a water shower to cool the product.

Cooked products were then tested for a smoke flavour

and the results indicated that a smoke flavour was imparted to the meat product enclosed within the smoke treated casing.

EXAMPLE 4

In another test, a tubular three layer casing was prepared according to the method of Examples 1 and 2 and then filled with water at 70°C and maintained at this temperature for 5 minutes.

Analysis of the water after this time using gas chromatography techniques indicated a transfer of smoke components from the casing into the water.

Other embodiments may be envisaged without departing from the scope of the present invention. For example, a flat film incorporating liquid smoke may be produced which may be wrapped around a food product, and polymers other than polyamide may be used. Flavouring agents other than liquid smoke may also be used in the same way as described herein for liquid smoke.

CLAIMS

1. Use of a loadable polymer in the preparation of a polymeric film suitable for wrapping food products, wherein said loadable polymer comprises a food flavourant, colourant and/or perfume.

2. Use according to claim 1 wherein said flavourant, colourant and/or perfume is in liquid form or as a solution.

3. Use according to claim 1 or claim 2 wherein said flavourant and/or perfume is chosen from the group consisting of aroma extracts of garlic, caraway seed, pepper, red pepper, grill flavour and mixtures thereof.

4. Use according to claim 1 or claim 2 wherein said colourant is chosen from the group consisting of annatto extract, erythrosine, amaranth, brown FK, tartrazine, black BN and caramel and mixtures thereof.

5. Use according to claim 1 or claim 2 wherein said flavourant, colourant, and/or perfume is liquid smoke.

6. Use according to claim 5 wherein said liquid smoke is an alkaline aqueous solution liquid smoke.

7. Use according to any preceding claim wherein said

loadable polymer is selected from the group consisting of polypropylene, polyethylenes, and polyamides.

8. A method of preparing food casing comprising the steps of:

providing a loadable polymer;

loading said loadable polymer with liquid material to give a loaded, loadable polymer; and

mixing and extruding said loaded, loadable polymer with a base polymer to give a food casing.

9. The method according to claim 8 wherein said liquid material is an aqueous liquid smoke solution.

10. The method according to claim 8 or claim 9 wherein said loadable polymer is provided as microporous nylon-6 pellets.

11. The method according to any one of claims 8 to 10 wherein said base polymer is selected from the group consisting of polyamide 7, polyamide 6,6, polyamide 6,10, polypropylene, polyethylene, and mixtures and copolymers thereof.

12. The method according to claim 9, 10 or 11 wherein said liquid smoke solution is a 25% by weight aqueous solution of liquid smoke produced by diluting a 50% by weight aqueous solution of liquid smoke with water.

13. The method according to claim 12 wherein said liquid smoke solution is loaded into said nylon-6 pellets by mixing and the resultant mixture heated to about 50°C-90°C, and subjected to a pressure below atmospheric pressure.

14. The method according to claim 13 wherein said loading gives a total water content of the liquid smoke loaded polymer of about 3%.

15. The method according to any one of claims 9-14 wherein 3% by weight of liquid smoke loaded, loadable polymer is used compared to the total weight of base polymer and loaded, loadable polymer mixture.

16. A casing comprising a polymeric film wherein said film comprises liquid smoke and is produced using a liquid smoke loaded, loadable polymer.

17. The casing according to claim 16 which is a multi-layered film tubular casing.

18. The casing according to claim 17 wherein an inner layer of said casing comprises said polymeric film.

19. The casing according to claim 18 wherein said inner layer has a thickness in the range about 10μm-60μm.

20. The casing according to claim 17, 18 or 19 wherein an outer layer of said casing is impermeable.

21. The casing according to claim 20 wherein said outer layer has a thickness in the range about 10μm-60μm.

22. The casing according to claim 20 or claim 21 wherein said impermeable layer comprises polyamide or polyethylene.

23. The casing according to any one of claims 17 to 22 which is a three layered casing wherein the innermost layer comprises a polymeric film comprising liquid smoke produced using a liquid smoke loaded loadable polymer, the outermost layer is a polyamide, and a core layer disposed between the innermost and outermost layers is a polymeric tie layer.

24. The casing according to claim 23 wherein said core layer has a thickness in the range about 10μm-60μm.

25. The casing according to any one of claims 17 to 24 wherein said casing has a thickness in the range of about 20μm-200μm, and a flat width of about 20mm-500mm.

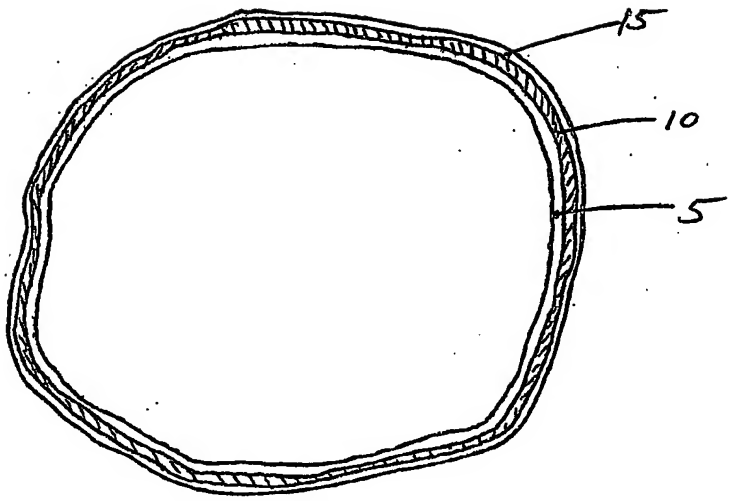

Fig 1

INTERNATIONAL SEARCH REPORT

PCT/GB 03/00444

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A22C13/00 B32B27/32 B32B27/34 B32B1/08 A23L1/232
A23L1/22 C08J5/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A22C B32B A23L C08J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 101 24 581 A (WOLFF WALSRODE AG) 28 November 2002 (2002-11-28) page 2, line 52 -page 4, line 55	1-7, 16-25
X	US 2002/039611 A1 (HEIDE CHRISTIAN AUF DER ET AL) 4 April 2002 (2002-04-04) page 2, column 1, paragraph 1 -page 3, column 1, paragraph 1 page 4 -page 5; examples 1-3	1-7, 16-25
X	WO 02 42364 A (SAKIT LTD ;VOSS SHARON (IL); GELDER DAVID VAN (IL)) 30 May 2002 (2002-05-30) page 1, paragraph 1 page 2, paragraph 2 page 4; claim 1	8,11

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
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Date of the actual completion of the international search	Date of mailing of the international search report
19 August 2003	23/09/2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Inceisa, L

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INTERNATIONAL SEARCH REPORT

PCT/GB 03/00444

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 986 957 A (CRYOVAC INC) 22 March 2000 (2000-03-22) page 2, paragraphs 1,4-6 page 17 -page 18; claims 1-9 page 3, line 6 - line 14,23-25,40-42	1-7, 16-25
A	EP 0 088 370 A (UNION CARBIDE AUSTRALIA) 14 September 1983 (1983-09-14) page 1, column 1 page 2, column 4 -page 4, column 2	1-25
A	US 5 716 656 A (STRIBLING KENNETH V) 10 February 1998 (1998-02-10) the whole document	1-25

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

PCT/GB 03/00444

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 10124581 A	28-11-2002	DE 10124581 A1	28-11-2002
		US 2003059502 A1	27-03-2003
US 2002039611 A1	04-04-2002	DE 10048718 A1	18-04-2002
		EP 1192864 A2	03-04-2002
WO 0242364 A	30-05-2002	AU 2400602 A	03-06-2002
		WO 0242364 A2	30-05-2002
EP 0986957 A	22-03-2000	EP 0986957 A1	22-03-2000
		JP 2000095285 A	04-04-2000
		US 2003031765 A1	13-02-2003
EP 0088370 A	14-09-1983	AU 1182883 A	08-09-1983
		EP 0088370 A2	14-09-1983
		JP 58193120 A	10-11-1983
		NZ 203447 A	11-10-1985
US 5716656 A	10-02-1998	US 5599570 A	04-02-1997
		AU 7323096 A	22-05-1997
		DE 69626033 D1	06-03-2003
		EP 0861033 A1	02-09-1998
		ES 2189887 T3	16-07-2003
		WO 9716071 A1	09-05-1997